ROBERT H. OWEN, JR., P.E.
Consulting Engineer & Meteorologist

Street Address:
1311 Middleton Street

First Class Mail:
P.O. Box 620858

Middleton, Wisconsin 53562-0858

Telephone: (608)831-6150

Facsimile:(608)831-6150

June 12, 2003

Ms. Kathleen Zuelsdorff
WEPA Coordinator
Public Service o mission of Wisconsin
P.O. Box 7854
Madison, WI 53707-7854

Re: ERGS DEIS Comments—General, CO_2, Fuel Diversity, and Energy Efficiency

Dear Ms. Zuelsdorff:

Before addressing some specifics, permit me to offer a general objection to the PSC's approach to doing an EIS in this case. This effort was started too late, and consequently there has not been enough time for the public to address the DEIS in this case. The lack of time is compounded in some cases, such as the case of carbon dioxide, by misleading information in the DEIS.

These are my comments on the ERGS DEIS as to CO_2, fuel diversity, and energy efficiency, three important topics to which the DEIS did not do full justice.

Carbon Dioxide

Carbon dioxide is a topic which utilities and their regulatory marionettes such as your managers do not much like to discuss. However, it is a subject which the ERGS FEIS must discuss much more conscientiously than it was discussed in the DEIS.

I am told that the greenhouse gas emissions section of the DEIS on page 170 was reviewed by someone at DNR. Was the reviewer awake at the time?

Of the four CO_2 emissions figures prominently presented in the DEIS at page 170, two are erroneous, and none are adequately explained. The three last figures, for example, are taken from an early 90's DNR-sponsored study estimating year 2000 emissions. Nowhere does the DEIS mention this. The second-last figure inaccurately reports the study estimate. It was actually 46,300,000 tpy for transportation.

Most significantly, the ERGS figure understates actual potential ERGS CO_2 emissions by at least a factor of 11, assuming 80% ERGS capacity factor. This kind of error is appalling and indicates an inappropriately flip attitude toward a serious environmental problem, particularly in the context of a supposedly reviewed document issued by a supposedly expert agency.

Worse yet, this DNR and PSC-sponsored document had no input whatever from the DNR's climate-change specialist, Eric Mosher, who had directed the study the DEIS took figures from. He would undoubtedly have caught the error in ERGS emissions if given the chance to review or contribute to this DEIS. Why was he not given that chance?

A few days ago, you informed me in your inimitably imperious tone that you and your illustrious colleagues were too busy to discuss the DEIS further.

Could it be that the learned management of your august agency is and was not interested in discussing the potentially disastrous effects of continually increasing CO_2 emissions and atmospheric concentrations on the complex earth-atmosphere-ocean system on which human life on this planet depends and thus decided to exclude the one state employee most qualified to expound on this subject from the DEIS effort altogether?

Is this why Mr. Mosher first heard of the ERGS DEIS from me on June 5 when I asked him about the prior DNR study misquoted in the DEIS?

Given an opportunity to participate in the FEIS process, I am confident that Mr. Mosher would be able to assist you in improving the quality of your carbon dioxide work product by several orders of magnitude.

In the meantime, permit me to mention a few of the concerns scientists have about unchecked carbon dioxide emissions:

(1) they may heat the earth's atmosphere significantly, creating vast climate changes and displacing plant species by hundreds or even thousands of miles in a few decades;
(2) they may wreak havoc with agricultural and silvicultural systems which developed in a very different climate regime, imperiling the food supplies and livelihoods of billions;
(3) they may flood low-lying areas on the coasts and low-lying oceanic islands;
(4) they may create sudden climate shifts to colder climates in some regions, including Northeast North America and Northwest Europe, if they trigger shifts in major oceanic currents;
(5) they may cause a serious reduction of lake levels in the Great Lakes;
(6) they may increase the probability and severity of storms;
(7) they may increase the frequency of killer heat waves and ozone episodes;
(8) they may continue to curtail the x-country ski season here; and
(9) they may promote tropical diseases (e.g., west Nile virus) in areas like Wisconsin formerly free of such scourges.

Some of these possible effects are controversial among scientists. Even more so, most are controversial or even dismissed entirely by conservative ideologues.

However, most real atmospheric scientists of all political shades and stripes <u>are</u> concerned about global climate change. There is no dispute that carbon dioxide concentrations <u>have</u> increased drastically in the last 150 years and continue to rapidly increase. There is no dispute that much

of the world has seen a trend toward increasing mean temperatures in recent decades. There is very broad agreement that carbon dioxide is a major driver of the changes seen to date. There is broad concern about just where we may be headed among scientists even if there is none at all among agency marionettes and utility puppeteers at 610 Whitney Way in Madison.

The scientific concerns include concerns that CO_2 concentration increases may indirectly damage human health. Indeed, three states have commenced a lawsuit against EPA this very month contending that carbon dioxide emissions should be regulated as criteria pollutants under the Clean Air Act.

In putting carbon dioxide in context, it is important to consider the differing time scales on which a coal plant may be used as compared to another carbon dioxide-emitting appliance. WE proposes to operate its coal plants for about 60 years. This is about twice as long as a wind farm operates, three or four times as long as a furnace operates, and about six times as long as a car or truck operates. All of the other carbon dioxide-emitting devices will be replaced by newer, presumably cleaner, devices several times before the black elephant coal plants proposed in this case stop spewing carbon dioxide into the heavens. Indeed, our descendants may mostly be driving fuel cell vehicles powered by wind-generated hydrogen and living in off-grid homes powered by on-site hydrogen-fueled fuel cells well before these monstrous facilities are retired. WE is asking for the right to spew massive quantities of carbon dioxide well beyond the lifetimes of most of the readers of the FEIS.

You must disclose the scientific concerns about global climate change in the FEIS. Although you did not do so in the DEIS and are presently in violation of Wisconsin law, you can admit and correct your mistakes, fully disclose the scientific concerns, stop misleading and stonewalling the public, and write a much improved FEIS which treats CO_2 emissions as a real scientific concern, not an ideological diversion.

You must also disclose that carbon dioxide emissions may be taxed in the future, adding further economic insult to the injury to Wisconsin's economy associated with additional multi-billion-dollar purchases of out-of-state energy.

Please note that the European Union proposed penalty for carbon dioxide emissions above the cap level for which an emitter has allowances is 40 Euros/metric ton ($42.65/ton) for 2005 to 2008. Currently, forward contracts for carbon-dioxide emission allowances are trading at 5-7 Euros/metric ton ($5.33-$7.46/ton) in Europe. The WE "carbon tax" of $3/ton is a joke. Any real tax would be substantially higher than the market price of allowances.

After addressing the numerous deficiencies of the DEIS, you can resume dancing to the tune set by your WEPCo sycophant managers, "I'm your puppet," while quaffing some highly-carbonated beverage.

Fuel Diversity

The fuel diversity discussion in the DEIS is inadequate because it does not address how in-

creased use of renewable energy in Wisconsin could improve the diversity of the electric system and address some of the economic risks of excessive dependence on natural gas.

I believe part of the current difficulty with natural gas prices is a short-term problem likely to be resolved long before any ERGS coal unit can be brought on line. This problem may be associated with inadequate financing being made available to natural gas drillers, a side-effect of recent financial scandals in the energy industry. I believe it is highly probable that Congress will move aggressively to solve this problem before the year is over in the wake of recent statements of Alan Greenspan and that natural gas shortages will disappear by 2005 as drilling activity increases. The DEIS should focus on longer-term issues.

Longer term, adding renewable energy to our electric supply portfolio is a very effective way to dampen natural gas price spikes. While at present, natural gas mostly substitutes for oil and vice versa, in the long run wind energy could play a larger role in displacing both oil and gas, and this would likely have a beneficial influence on fuel prices. The FEIS should address this effect.

The DEIS mentions but gives insufficient emphasis to the economic characteristics of CT and CC gas-fired generation, especially versus wind generation in the next decade or two and solar generation as well in the longer term. Wind is low in operating cost (negative with tax credits), hence would readily displace natural gas in any utility's economic dispatch when available. Solar is also low in operating cost and would displace gas-fired generation.

Both wind and solar would reduce natural gas consumption to support the electric grid. This would tend to dampen upward pressure on gas prices. The FEIS should acknowledge this.

In addition, wind would tend to shift the mix of thermal generation toward lower-capital-cost, smaller, CT instead of CC or coal plants. These smaller plants could be integrated into the grid in a more distributed fashion, tending to generate transmission cost savings as compared to larger scale thermal generation plants. Solar P.V. installations would also have grid benefits in most of Wisconsin. PSC analyses reflected in the DEIS do not consider distributed grid benefits. With multi-billion-dollar transmission investments on the table in Wisconsin, it is high time to pay much closer attention to grid savings and costs of different generation sources.

Energy Efficiency

The DEIS makes an effort to deal with energy efficiency, but could be significantly improved with even minimal support from PSC management.

The shortcomings in this area are in no way the responsibility of the gritty half-time public servant who continues to do her darnedest to serve Wisconsin's citizens while her marionette managers systematically deprive her of the resources necessary to properly do her job. I salute Carol Stemrich, an example of courageous and conscientious dedication to public service! Carol's dedication and effort shine like a ray of sunlight through even the cloudy DEIS lens created in the cesspool of mismanagement and regulatory cooptation which is today's PSC.

What also shows through, however, is that PSC management refuses to implement Wisconsin's energy priority law, Wis. Stat. § 1.12(4), which unequivocally states that cost-effective energy efficiency measures are to be implemented first.

Instead of putting efficiency first, the commission appears to have adopted a policy of eliminating energy efficiency expertise first as it downsized its staff in recent years. We are now reaping the fruits of this grotesque misallocation of resources in the ERGS proceeding. There are huge gaps in knowledge as to the potential for additional cost-effective energy efficiency measures, and they are reflected in the DEIS. These are related to the fact that the PSC now has a single half-time employee, albeit an able one, Carol Stemrich, dealing with this subject matter.

They are related to the absence of energy efficiency studies in the last eight years.

They are also related to the fact that inept PSC Electric Division management, abetted by the "three wise monkeys" in charge (See No Evil, Hear No Evil, and Speak No Evil), has effectively absolved WE of its obligation to submit reasonable energy efficiency data in support of its "application" for ERGS. The responsibility for this misfeasance goes right to the top, where the AB/B duet/trio is apparently too busy serenading WEPCo with endless renditions of "I'm your puppet" to discharge its statutory responsibility.

It is time to change the music to a new tune more consistent with Wisconsin law and the clear economic interest of Wisconsin citizens in greater energy efficiency.

To this end, I propose that the Commission demand that WE forthwith provide sufficient data to permit determination of its additional cost-effective energy efficiency potential, and if WE does not do so, summarily dismiss the ERGS application before the hearing.

The legal justification for this is simple. Energy efficiency is Wisconsin's top priority resource. Wis. Stat. § 1.12(4)(a). The burden is on WE to prove that ERGS "satisfies the reasonable needs of the public for an adequate supply of electric energy." Wis. Stat. § 196.491(3)(d)2. This burden cannot be met if WE cannot disprove the hypothesis that energy efficiency can meet the postulated need. WE has pre-filed its case in chief, and it does not disprove the hypothesis.

The DEIS has some shortcomings, but it amply refutes WE's case in chief on energy efficiency.

What WE's case on energy efficiency does prove is that WE has contempt for the law and the applicable rule, PSC 111.53(d)1 & 2, and, by extension, the citizens of Wisconsin who would have to pay for its bad choice to prefer Pennsylvania coal over homegrown energy efficiency.

As the DEIS points out at page 54, almost "every dollar spent on coal . . . leaves Wisconsin and our economy," while "energy efficiency can . . . improve the state's economy in general."

WE is using the same consulting firm in the ERGS Case which self-destructed on cross-examination in the PWGS Case last year in the face of staff warning that this outfit is unable to supply

the information the PSC staff needs to make the requisite careful analysis of energy efficiency.

That the sleepy "regulators" at 610 Whitney Way have let the ERGS farce get this far is ample testament to the need for new blood to invigorate the penthouse level of the agency. To let it go any further would raise new questions about misfeasance in high places and whether something more sinister than poor management and garden-valley ineptitude is driving the forlorn derelict SS PSC, only recently provisionally rescued from shipwreck on transmission CPCN shoals, as it sputters, with no one to be seen at the helm, toward another generation CPCN ice berg or judicial review torpedo.

As to the substantive focus of the FEIS energy efficiency discussion, I have three additional comments.

First, the FEIS should recognize that studies based solely on avoided generation cost seriously understate the economic potential of energy efficiency. Efficiency avoids generator operation and construction, but it also avoids transmission and distribution construction. The resulting potential savings in T&D are large and are not accounted for in the STEP study, as I understand it. Consequently, the STEP study understates the real value of energy efficiency by at least $.02/kWh, even more in some cases. This means that the real economic potential for efficiency was much larger than the STEP study identified in 1995.

Second, the DEIS does make the point that energy efficiency has decreased in cost in many cases since 1995. The FEIS should also make the companion point that the cost of generation, typified by the likely total cost of ERGS in the range of $.05 per kWh, has increased since 1995. Again, this increases the real economic potential for energy efficiency.

Third, while the main focus of the DEIS is appropriately placed on energy efficiency potential for WEPCo, attention should be given in the FEIS also to the energy efficiency potential of other utilities or entities like MGE, WPPI and DPC which may share in ERGS ownership or control if this black elephant is built. They too have the obligation to capture reasonable energy efficiency savings before imposing this monstrosity on their customers. The universe of customers whose efficiency savings could avoid the need for the proposed ERGS plants is substantially bigger than WEPCo customers alone.

Very truly yours,

Robert H. Owen, Jr.
cc: Ms. Carol Stemrich
Mr. Ken Rineer
Mr. Eric Mosher
Mr. Jeff Kitsembel

ROBERT H. OWEN, JR., P.E.
Consulting Engineer & Meteorologist

Street Address:
1311 Middleton Street

First Class Mail:
P.O. Box 620858

Middleton, Wisconsin 53562-0858

Telephone: (608)831-6150

Facsimile:(608)831-6150

May 27, 2003

Mr. Paul Helgeson
Renewable Energy Engineer
Public Service Commission of Wisconsin
P.O. Box 7854
Madison, WI 53707-7854

Re: ERGS DEIS Comments on Renewable Energy Sources

Dear Mr. Helgeson:

These are my comments on the renewable energy portions of the ERGS DEIS at pages 59-66.

I view this section of the DEIS as very important, because several categories of renewable energy have the technical and economic potential to replace the proposed ERGS facility entirely. This point needs to be expressed more expansively in the FEIS.

An EIS is supposed to offer alternative visions. This one needs to offer a considerable expansion in vision. Renewable energy has a very exciting story to tell. Please tell it.

Wind

You identify wind as a renewable option for Wisconsin. It is a much bigger option than you acknowledge.

There are some minor errors in your wind discussion, which I understand you plan to correct in the FEIS.

I will discuss some more significant issues here, including (1) our state's wind power potential and (2) wind power productivity.

1. Wisconsin Wind Potential

The Commission staff continues in the DEIS to misuse the 1991 Battelle PNL "Windy Land" study in somewhat the same manner it was misused in the Port Washington Case last year. This study was written in an era when 100-200 kW wind turbines were commonly being installed on 30-35-meter towers. It must be used with caution today when 1.5-2.0-MW wind turbines are typically being installed on 70-80-meter towers, and when some turbines will soon be available with 100-meter towers.

The study is being misused in two ways. First, it is being used without regard to the actual increase in wind potential per square mile being achieved by today's larger-scale wind turbines. Second, it is being used by uninformed people to understate Wisconsin's usable wind resource.

As to the first point, I view 12 MW per square mile as a significant understatement of what is actually achievable with today's MW-scale technology. I believe an average of 15 MW per mile is closer to the current reality, and this is likely to increase further after 2003.

As to the second point, any analysis that does not examine increasing tower height is likely to seriously underestimate Wisconsin's economically available wind resource. Wind speed at inland Wisconsin sites increases rapidly with height above ground level. At most potential wind sites away from the Great Lakes, annual average wind shear exponents are at least .19 or .20 below 100 meters.

As a practical matter, any site identified as a Class 3 Site by the Battelle PNL study (i.e., 14.3 mph or higher at 50 meters), would have a Class 4 or higher wind resource (15.66 mph or higher) at 80 meters if it had even a .19 wind shear exponent. Thus, what the Battelle Study actually tells us, considering today's taller tower realities, is that Wisconsin has 3500 square miles of Class 4 or greater inland wind resource (mean 15.66 mph or higher) at 80 meters.

According to this height-corrected approach, assuming 15 MW per square mile, Wisconsin has an inland potential of 52,500 MW at Class 4 or better wind resource sites with today's commercial technology. With next year's or 2005's technology, this potential will be even higher.

While not all of this potential could be realized for various land-use-related reasons, enough could be realized to displace the entire energy production potential of ERGS.

It is completely indefensible to maintain that Wisconsin has only 2040 MW of Class 4 wind resource, as the DEIS suggests. Wisconsin has more than this in Class 5 potential inland.

Wisconsin also has substantial offshore potential in the Great Lakes, especially in Lake Michigan. This potential includes hundreds of square miles of depth of less than 100' in S.E. Wisconsin, especially off S. Milwaukee, Racine and Kenosha Counties. It also includes hundreds of square miles further offshore E. of Milwaukee in somewhat deeper water on the mid-lake ridge between Milwaukee and Muskegon. This potential is all Class 4 (most of it Class 5) or higher, with today's technology and would support about 20 MW per square mile with an extremely modest footprint of much less than one acre of surface affected per square mile. The Wisconsin waters of Lake Michigan could support thousands to tens of thousands of MW of wind development. The FEIS needs to acknowledge this potential rather than ignore it.

The DEIS is extremely unrealistic in its installation and operation cost estimates for offshore wind. Offshore wind in Southern Lake Michigan is likely to be significantly less costly to install and operate than projects in salt water. Lake Michigan has a considerably more benign installation, corrosion, and operation climate than the locales developed offshore in

Europe to date. Furthermore, Wisconsin's potential near-shore sites in Lake Michigan are ideally situated to tie into the ATC 138-kV transmission system in S.E. Wisconsin, so they would not be nearly as expensive as most offshore sites elsewhere to connect to the existing grid.

I believe that the DEIS installed cost estimate for offshore wind is at least $300 per kW too high for sites close to shore in S.E. Wisconsin, and even this cost will decline as offshore technology is further developed.

I also believe that the O&M cost of offshore wind in Lake Michigan will ultimately be only slightly higher than for inland sites. Lake Michigan's more benign climate as compared to the oceans of Northwest Europe is a significant factor in tempering O&M costs. There will be far fewer days when weather precludes maintenance on Lake Michigan. In addition, it appears that there will be no site lease costs for offshore sites in the lake, unlike inland.

The discussion in the DEIS suggests, incorrectly, that Wisconsin would need to develop low Class 3 Sites to produce large amounts of wind energy. This is simply not true with today's taller tower wind technology. Nor are Class 3 Sites as unproductive as the DEIS suggests.

2. Wisconsin Wind Power Productivity

Wisconsin has at least three sites at which apparent Class 3 wind resources have been developed for wind farm purposes. In each case, the wind farm has produced at over a .20 capacity factor, despite using smaller than optimal rotor diameters. Examples include the Montfort, Lincoln, and Rosiere Wind Farms.

In the case of Montfort, where FPL Energy is operating 20 ENRON Wind 1.5-MW turbines (70.5 meter rotor version) on 65-meter towers, the Badger Windpower entry on WEPCo's 2002 FERC Form 1 Report (p. 326) suggests that that project operated at a .24 capacity factor (including losses) in 2002 with regard to WEPCo's 25.5-MW share. This site was not expected to have a mean wind speed at hub height in excess of 15 mph.

At the Rosiere Site, MGE has operated 17 Vestas V-47/660-kW turbines on 65-meter towers since July 1999, achieving an average capacity factor of .23 for calendar year 2000 through 2002 (including losses). MGE's wind measurements at 65 meters at Tamarack and Eagle Roads averaged 15.1 mph for this three-year period. However, these measurements are made at a site which is somewhat windier than the average for the turbines in the Rosiere Wind Farm. I estimate that the mean for the average Rosiere wind turbine is significantly under 15 mph at hub height.

At the Lincoln Site, WPS has operated 14 Vestas V-47's on 65-meter towers since July 1999, achieving an average capacity factor of .21 for calendar year 2000 through 2002 (including losses). WPS has not measured wind speed at this site, but I measured the wind speed there at 10 meters for several years. I estimate that the mean for the average Lincoln turbine at hub height is about 14.5 mph. The cramped spacing of turbines at this site increases array losses.

The experience to date at these well-maintained wind farm sites indicates very clearly that well-planned Wisconsin Class 3 wind resource sites produce considerably better than .20 capacity factors. The use of a .20 capacity factor for Class 3 in economic modeling would be inconsistent with this state's growing experience with producing more wind energy at such sites.

Part of the reason for this greater-than-.20 capacity factor experience is that Wisconsin has lower mean temperatures and higher mean air densities on a sea-level-adjusted basis than are assumed in standard wind turbine ratings.

Also of interest is the experience of Wisconsin Electric at its Byron Wind Farm Site to date. From 2000 through 2002, the two Vestas V-47's on 65-meter towers at this site produced 9345 MWh, indicating an average capacity factor of .27, including losses. I also measured within about 100 meters of this site using a 10-meter tower for several years. This site is windier than the previous three sites, with a mean wind speed of about 15.8 mph at hub height, I estimate. This is a low Class 4 wind resource (at 65 meters), but this site is maintained by a Rosiere-Lincoln-based (Vestas) maintenance team, which has to travel at least two hours one way to get there; thus, it may have larger availability losses than a locally-maintained wind farm.

As you may be aware, the Vestas turbine is not optimized for Wisconsin wind conditions. It has a smaller rotor relative to generator size than such turbines as the GEWE 1.5 (77-meter) and NM82 (1.65 MW) wind turbines, which are machines more optimized for a Wisconsin-type wind regime and are both now available with 80-meter towers.

Wisconsin has not yet developed wind resources at mid-to-high Class 4 wind resource sites, although it soon will at such sites and Class 5 sites as new taller tower technology is employed. We can safely predict higher capacity factors as such higher-wind-speed sites are developed using turbines like the GEWE 1.5 (77-meter) and NM82 (1.65-MW).

Even at a 16-mph site (low-to-moderate Class 4) with 15% overall losses (including array losses), these machines would produce at .30 and .31 capacity factors, respectively, according to the manufacturer's power curve.

With the tower heights now available for MW-scale machines, Wisconsin has some 17-mph in-land sites and many potential 17-mph-or-higher offshore sites, and the number of both will grow as tower heights increase. These would have higher capacity factors, up to about .34 or .35. Offshore sites in some cases could reach .40.

Capacity factors would tend to increase by about .01 for individually-sited turbines distant from neighboring turbines due to an absence of significant array losses in such cases.

I believe Wisconsin has many hundreds, possibly more than 1000, sites suitable for individual wind turbines. Our land-use and topography patterns in some parts of the state favor individual turbines distant from others. This kind of distributed development can be extremely efficient, minimizing array losses, electrical losses, and grid-connection investment.

I would suggest that modeling use a capacity factor of .35 (including losses) for Class 5, .32 for Class 4, and .27 for Class 3 wind farm installations, limiting the last category to no more than 20% of all wind installations, with about 20% of inland installations in Class 5 by 2005. I would model offshore installations as 80% Class 5, the rest Class 4 initially, and all Class 5 by 2010. If individually-sited turbines are modeled, they should be modeled at .01 higher capacity factors to reflect the absence of array losses in such cases. With the new large rotor, tall tower, technology now starting to come on line, Wisconsin will very seldom develop less-than-15-mph sites in the future. Most new wind installations will have more than a 15.66 mph (Class 4) wind resource, and virtually all will use large-rotor technology which will out-produce the Vestas V-47 at Wisconsin wind sites. Capacity factors used in modeling should reflect current commercial and near-future wind realities relevant to Wisconsin, not obsolete technology or technology optimized for different wind regimes which wind developers will not use here.

Wind is an increasingly competitive technology because it has not stood still since 1991. PSCW wind economic analyses need to be updated to 21st Century realities. Due to larger rotors and taller towers developed over the last 12 years, wind is now the most economic technology available to produce electric energy in Wisconsin, but PSCW models and some of your colleagues appear to be stuck in an early 1990's time warp which has not quite caught up to the new reality.

Now is the time to catch up!

Wind could displace every single kWh proposed to be produced by ERGS, and Wisconsin's economy, Great Lakes fishery, and environment would be all big winners from the substitution of clean Wisconsin wind for unclean Pennsylvania coal.

Biomass

Biomass could also displace every kWh and every kW proposed to be produced by ERGS.

Biomass potential from on-farm digesters may be as much as an order of magnitude higher than the 30 MW you identify. While much of this potential is on large dairy farms, there may also be some potential at large poultry and hog operations, with the latter potential increasing as global warming progresses and Wisconsin grows more corn and soybeans. There does appear to be a strong trend toward increasing herd or animal waste unit size in all three industries. The 30 MW figure is probably about right for current potential, but current potential does not begin to capture the rapid trend toward increasing animal unit size and farm consolidation.

I suspect that your cost numbers are also too high for biogas technology. This is a relatively new technology (like wind 20 years ago). Costs will drop significantly. Biogas generation will be economical, certainly more economical than ERGS, before 2010. Also, it is worth noting that biogas generation is a base load resource.

I believe that your costs are too high for other biomass technologies as for biogas. If your costs were realistic, biomass would begin to significantly penetrate the generation mix by about 2010.

Like biogas technology, other biomass technologies are at a relatively primitive stage of development. They will be more economical after future technological development. The development of biomass gasification and liquid fuel technologies is particularly promising for future efficient use of biomass feed stocks. Current biomass combustion technologies are not very efficient, but future technologies could be much more so. This not only improves future economics but also increases the amount of the potential to supply kW from a given biomass feed stock or land base.

The retirement of aging coal and perhaps nuclear plants will give impetus to greater efforts to develop biomass technologies in this decade or soon thereafter. As a state importing more than 95 percent of its primary energy at an annual cost of billions of dollars, an economically inhibiting dependence WE proposes to increase with the construction of ERGS, Wisconsin stands to benefit economically from finding ways to efficiently use its biomass resources as local energy resources instead.

The economic benefits of biomass development to rural counties are especially significant. This realization will give impetus to greater efforts to develop local biomass energy sources as current budget crises ease in a few years.

Also, biomass, like wind, is an inflation-resistant alternative to high-priced natural gas.

I think the FEIS would be enhanced significantly if it incorporated an expanded discussion on how biomass could play an important role in a more energy-self-reliant Wisconsin economy. I would like to see some real vision of an alternative future in this area.

There are a lot of people in all counties of this state who would rather pay Wisconsin farmers than Pennsylvania coal miners and intervening railroads for their energy. I certainly would.

Photovoltaic Cells

I see solar too as working its way into the electric grid a decade or two hence.

Right now, p.v. power is very expensive compared to base load energy. But when p.v. installed costs get down somewhere near $1000 per kW, perhaps by around 2020, I think p.v. will begin to be integrated into the grid on a large scale as a summer-peak capacity resource, offsetting by-then-very-expensive-to-run-gas-fired CT's and substation and distribution line upgrades.

P.v. will be more valuable than its avoided energy cost, because it will also avoid distribution and transmission and summer peak generation capacity costs. In some places, p.v. may make inroads into the grid as a distributed generation resource much earlier than this.

If the EGEAS model does not allow you to factor the d.g. benefits of p.v. into your alternative analysis, you need to find a better method for doing the analysis. This is a substantial benefit of

this technology.

Eventually, roof-mounted p.v. cells will be major producers of grid electricity. This will happen well before the ERGS black elephant is mothballed. The FEIS should acknowledge this very broadly shared vision.

I suggest you figure out a way to estimate when p.v. will drop to $1000/kW and then figure out a method to work it into the generation mix. Solar is a future generation resource circa 2057. Coal is not. If you are going to entertain proposals to build 50-year-life coal-fired pollution factories, you need to think well past the next 12 months in terms of the cost and role of potential alternatives. Solar is an example of one that may take more than a decade to begin to assume its future major role, but it will drop in cost, and it will assume that role in a time frame relevant to the ERGS proposal. P.v. costs have been declining, albeit slowly, for decades.

You need to figure out a way to model solar reasonably so that it can compete in the capacity and energy mix in the relevant time frame. Using some MGE inflated capital cost for a historical p.v. project as a fixed cost for p.v. into the next several decades is unacceptable. Ignoring p.v.'s peak and d.g. benefits is also unacceptable.

You must treat p.v. as a real alternative to ERGS. You may not punt on this. Solar, like wind and biomass, is a higher priority energy resource than high-sulfur coal, and it will be very big in Wisconsin's electric energy mix some day.

Remember, 20 years ago, wind cost 30 or 40 cents per kWh too. Now, wind energy sells for less than 3 cents per kWh in some cases. Something similar will likely happen with solar in the next 15 years. Any realistic model must treat solar installed costs as dropping over time.

Fuel Cells and Hydrogen

Again, you must treat fuel cells as a real alternative, dropping in installed cost over time. Even if they are fueled with natural gas, due to their high efficiency, they may be preferable to ERGS. With the auto industry committed to developing fuel cells as auto power plants, the advent of affordable fuel cells right down to household scale is inevitable, probably by about 2010.

You should lay greater emphasis on the likelihood that fuel cells will ultimately be fueled with hydrogen derived from renewable energy sources like wind or solar which have a variable output determined by the natural flow of wind or light photons at the moment. This natural variability, so troublesome to some linear-thinking engineers of limited imagination, including a few authors of the DEIS, is actually an advantage if the wind or p.v. generation is allowed to supply either electrons to the grid or hydrogen to storage, depending on the relationship of the current natural energy stream to current electric demand.

Ultimately, wind generation is likely to produce hydrogen at lower cost than natural gas.

With fuel cells in the generation mix, wind, biomass, and solar p.v. could run the electric grid

without combustion of any fossil fuels or production of any net CO_2 or nuclear waste. The grid could utilize surplus wind (mostly) or solar energy to electrolise hydrogen from water, store it, and use the hydrogen in fuel cells later to meet grid needs when the wind and solar flows were insufficient. The entire electric system could be virtually pollution free. Indeed, it could produce surplus hydrogen to fuel transport, homes, industry and commerce too.

Fuel cells exist. They are getting cheaper. They will ultimately be major players in supplying electricity. They will be much cleaner and more efficient than most current generation systems burning fossil fuels. They may ultimately play a major role in our vehicles and homes. They may even ultimately give us a chance to get rid of significant parts of our electric/water grids.

Consider the possibilities. Perhaps one day we will have the option to replace We (Filthy) Energies at our houses with we ourselves, our clean home fuel cell, and our hydrogen purchased from Offshore Environmental Energies, our friendly Lake Michigan wind-hydrogen producer, a company which will not disgorge mercury to the lake, CO_2 to the atmosphere, and slush funds to every self-absorbed legislative leader in Madison in need of an extended term in a state institution with bars on the windows.

I would like to read much more about such visionary possibilities in the FEIS.

Staff Analysis of Renewables

I think the DEIS correctly appraises the prospects for the federal wind energy production tax credit.

However, in the wind capacity credit area, I believe 20 percent is too conservative. I would use a figure of about 80 percent of the expected wind capacity factor to represent its summer peak capacity value. For a mean future installation wind capacity factor of .32, I would expect wind summer peak capacity value to average about .25, with big year-to-year fluctuations.

Conclusion

An important difference between people who lead change and people who resist it is the ability of the former to visualize how the future can be different from the present. Be visionary as you make your key contribution to the ERGS FEIS.

The emerging story of progress in renewable energy technology is engaging and exciting. Let the reader share the vision of a brighter, cleaner, energy and economic future for Wisconsin!

Very truly yours,

Robert H. Owen, Jr.
cc: Kathleen Zuelsdorff